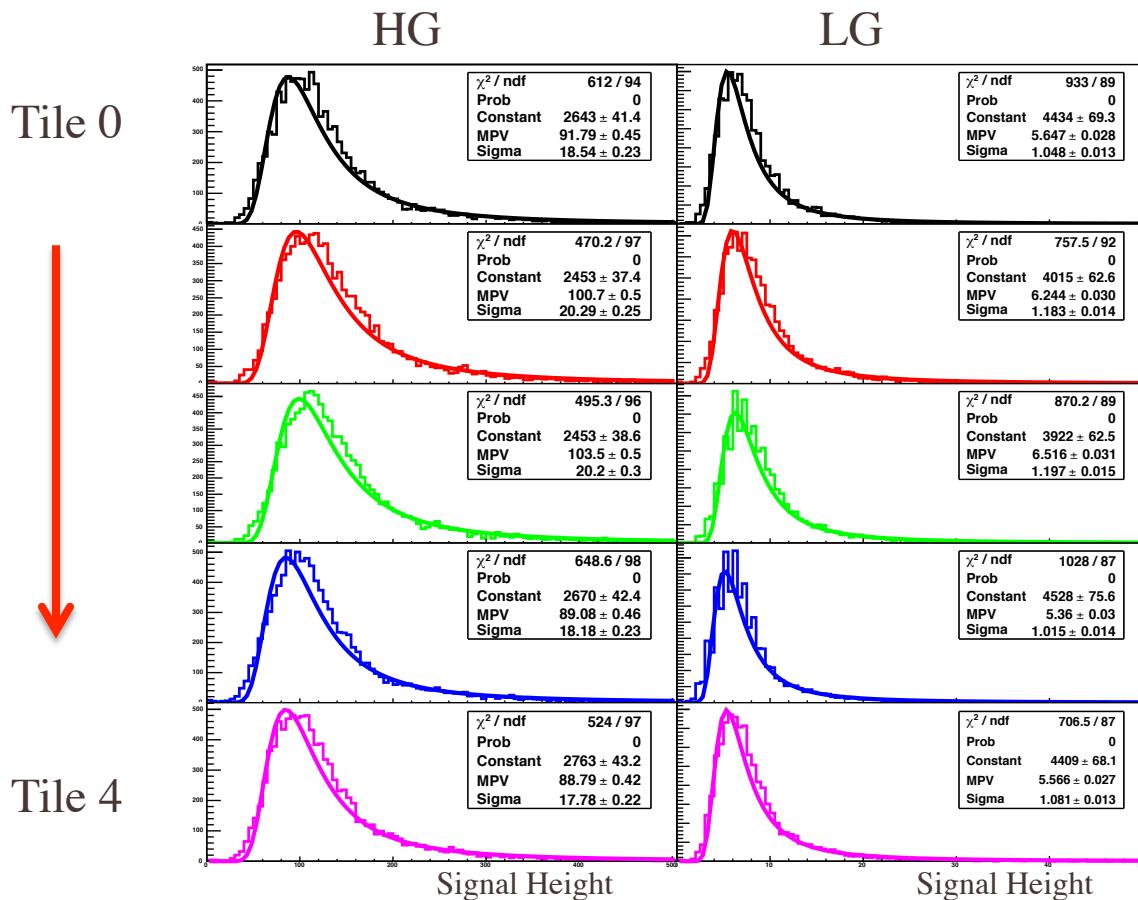


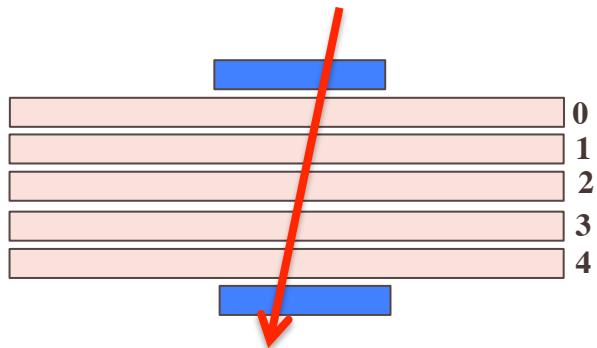
HCAL tile studies

Abhisek Sen, Megan Connors

Light output from the big tiles

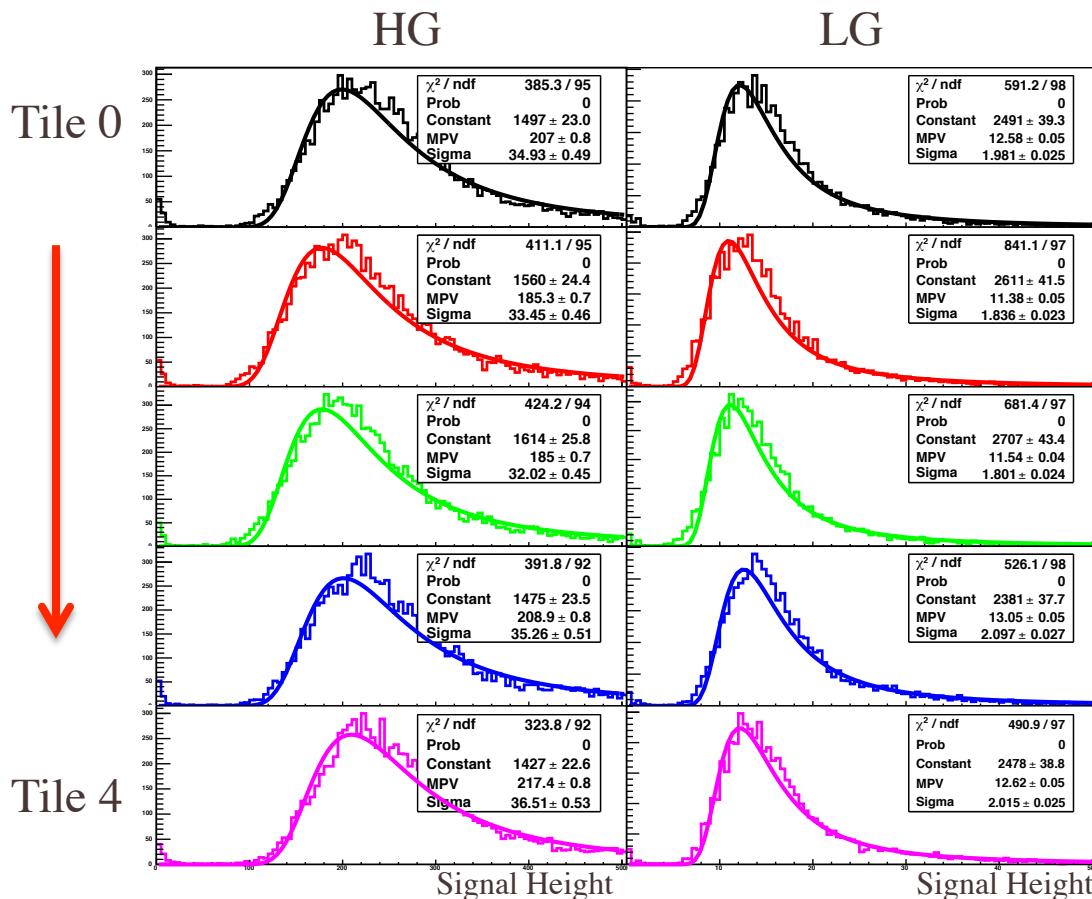


Cosmic running setup:

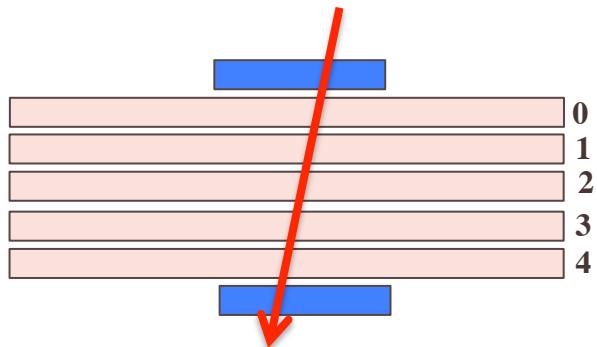


Overall a consistent light output from all the tiles.

Light output from the small tiles



Cosmic running setup:



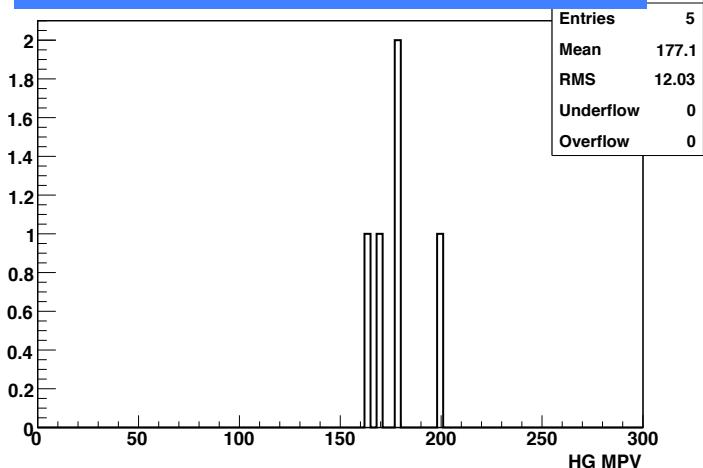
Overall a consistent light output from all the tiles.
Factor of 2x higher light output than big tiles.

Light output variation - MPVs

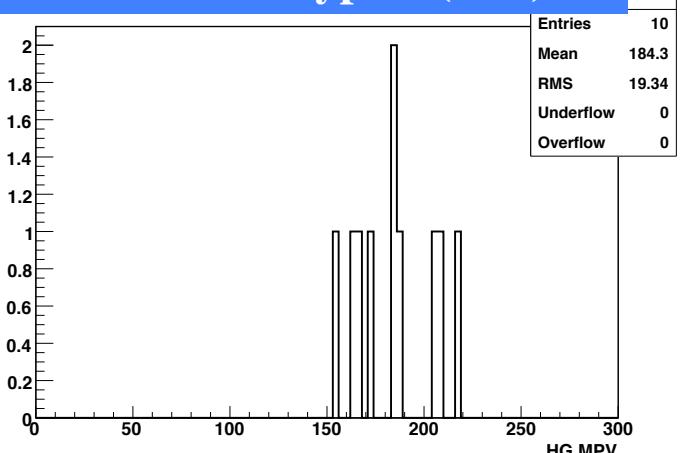
We created a Google excel sheet with all the MPVs

<https://docs.google.com/spreadsheets/d/1tj4oqnrEjb-JKBgQP0JEMEtcm2WcbDdqQLHkehOJChI/edit#gid=987579157>

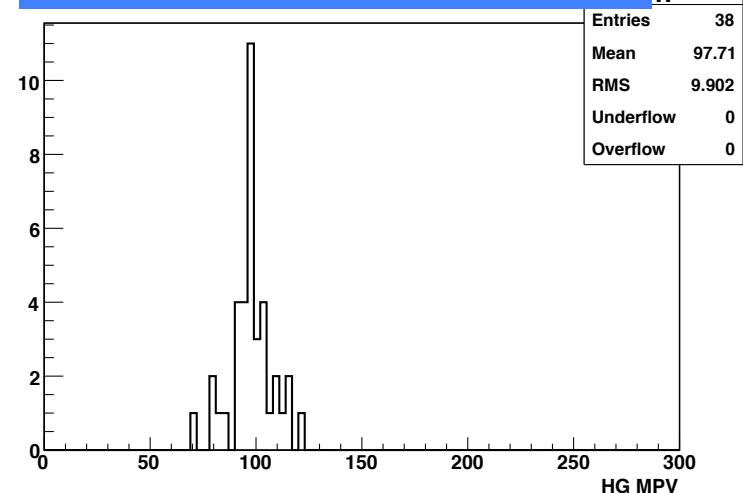
Inner HCAL Type 1 (IH1)



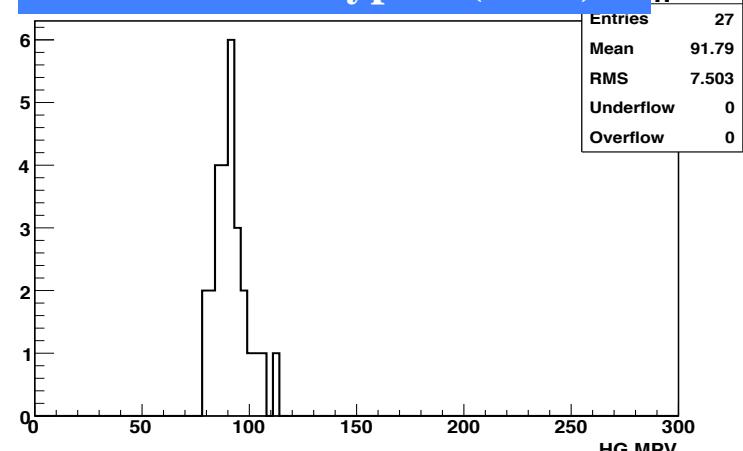
Inner HCAL Type 2 (IH2)



Outer HCAL Type 1 (OH1)

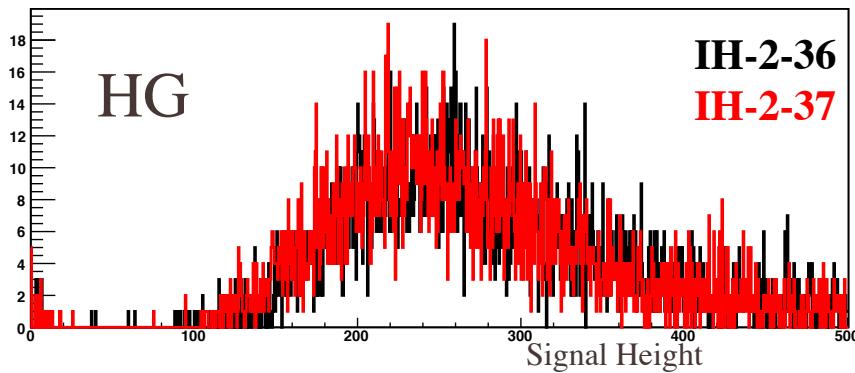


Outer HCAL Type 2 (OH2)



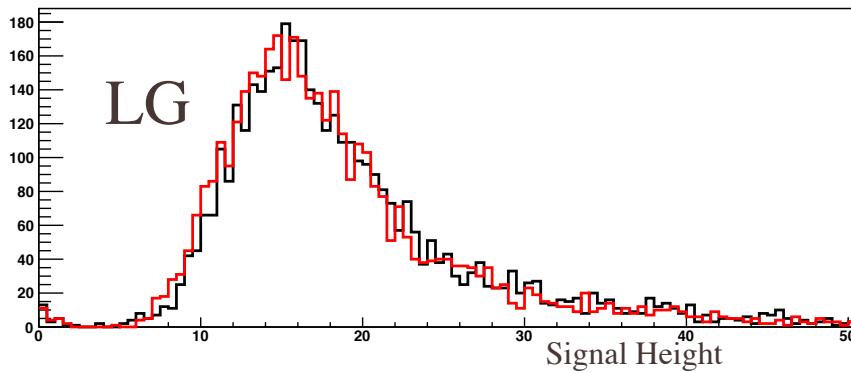
Light leak tests

Light leak test



Open box test for light leak

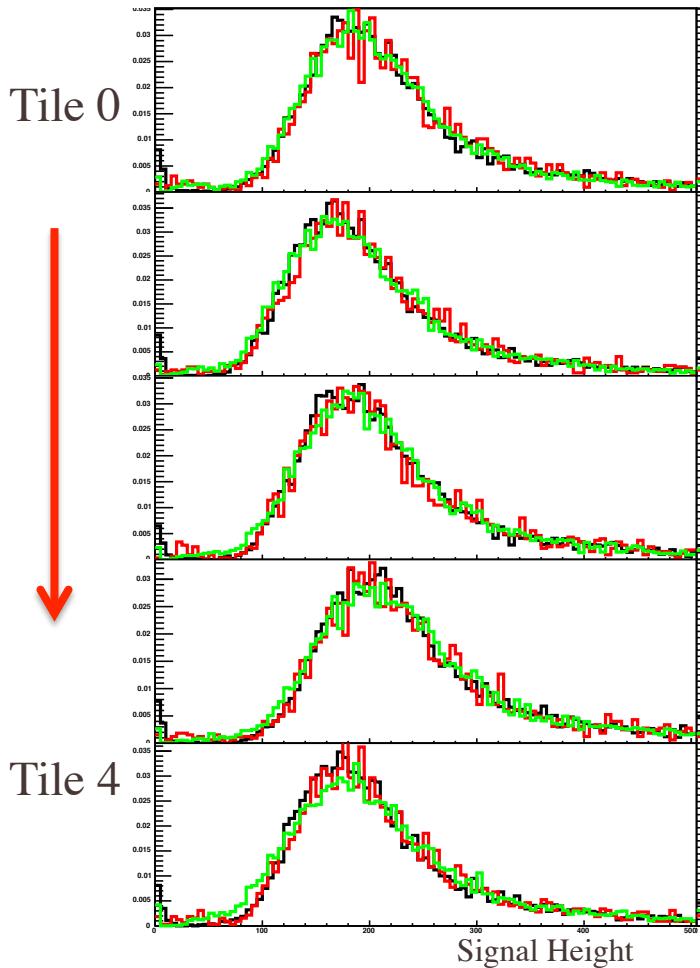
IH-2-36: Extra wrapped all sides.
IH-2-37: Extra wrapped only at holder.



IH-2-36: bias current~35nA
IH-2-37: bias current~70nA



How much more can it take?



Closed box:

Bias current -50nA/tile

Open box:

Bias current -4.24microA/tile

Open box + Flash light:

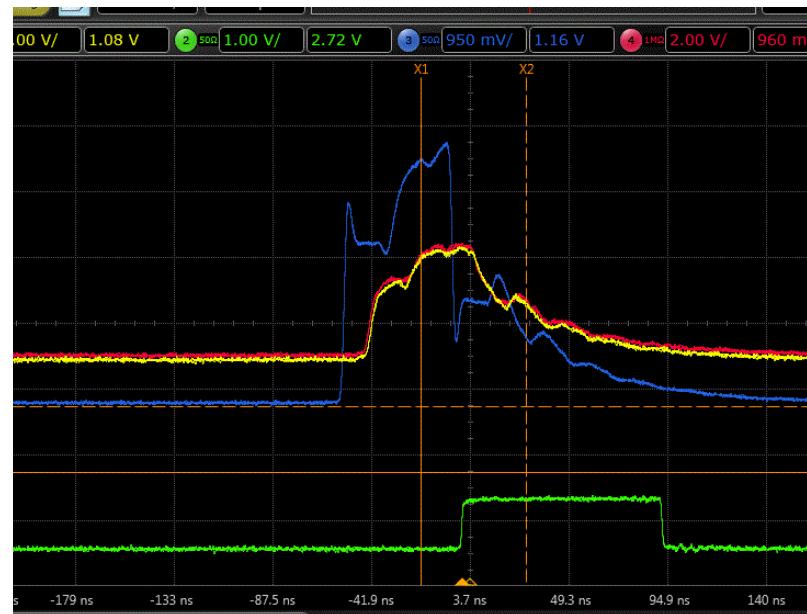
Bias current -14microA/tile

Tiles will be in-between the steel plates.
So the real life situation is somewhere
between closed box and open box.

Coating and wrapping provide a good light insulation for the tiles.

LED Calibration

LED tests

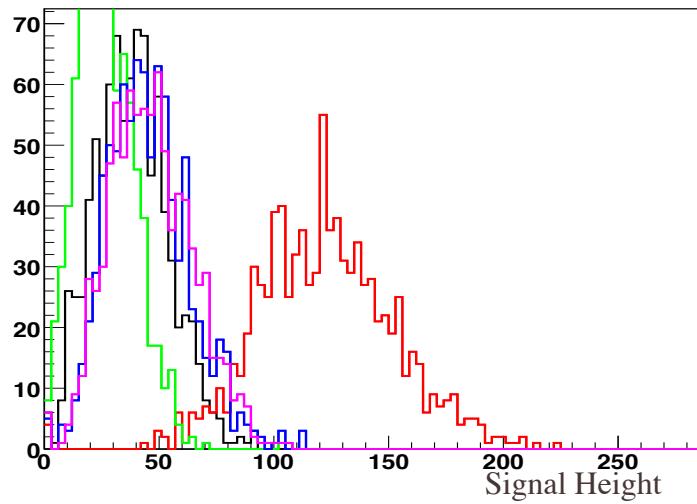


Generator
LED1
LED2
Trigger

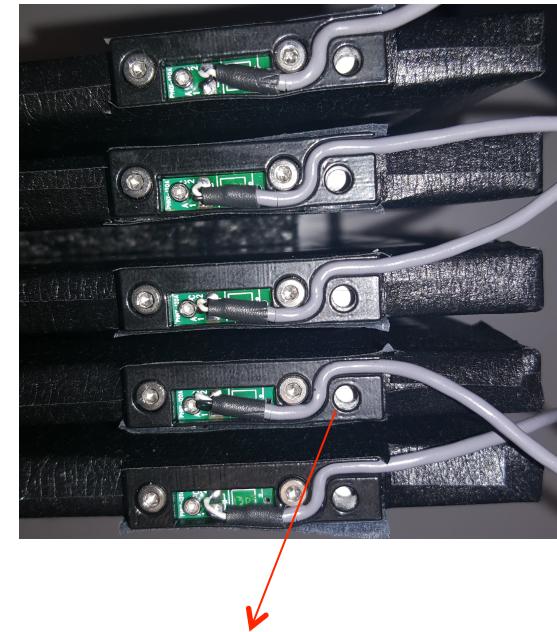
- Andrey made a simple LED splitter.
- Lot of reflections because signal from the generator was not terminated properly.
- I talked to Steve, he has some ideas about the design.
- We need to discuss the design.

LED next to SIPM

5 LEDs to 5 tiles



- Cosmic light output was similar for this tower.
- One of the tile had factor of 3 higher light output with LEDs

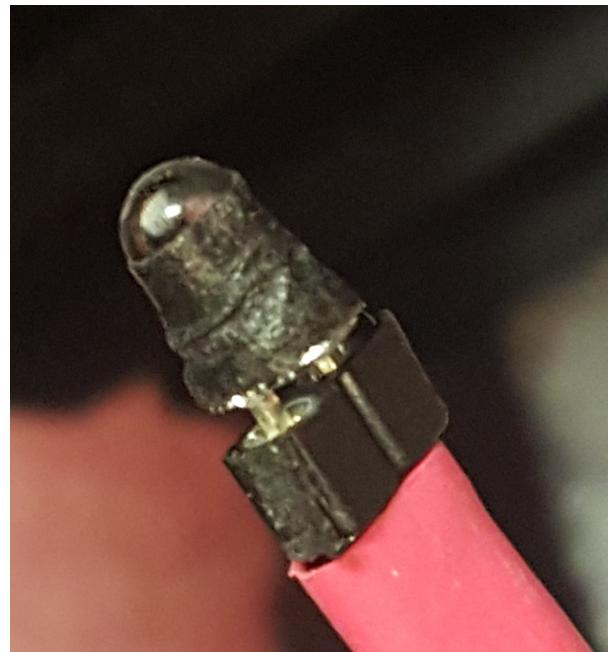
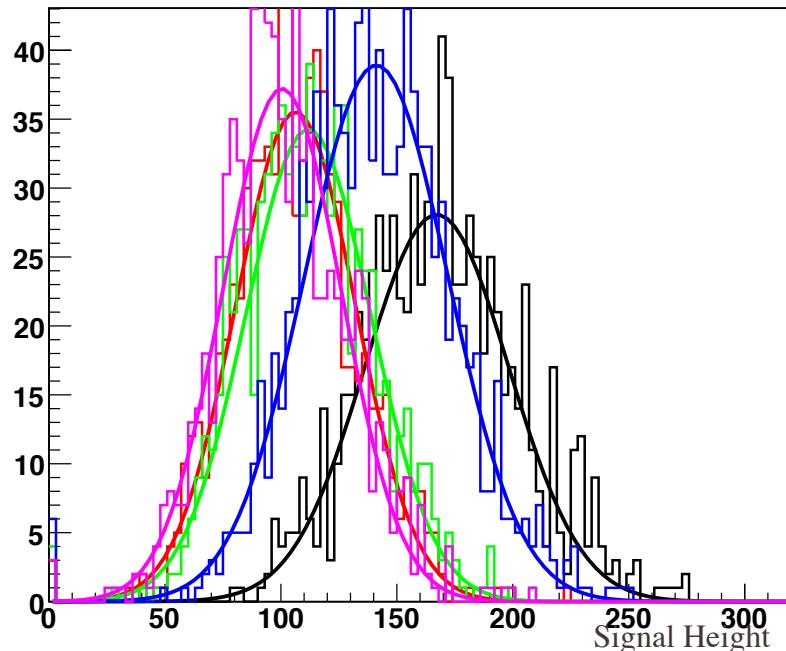


There are white coating underneath which has different thickness.

Lesson:

Cant use those holder holes unless we scrap the coating.

LEDs themselves needs calibration



- LED on the opposite end of the tile.
- Measured same tile light output using 5 separate LEDs.
- LEDs themselves needs calibration.

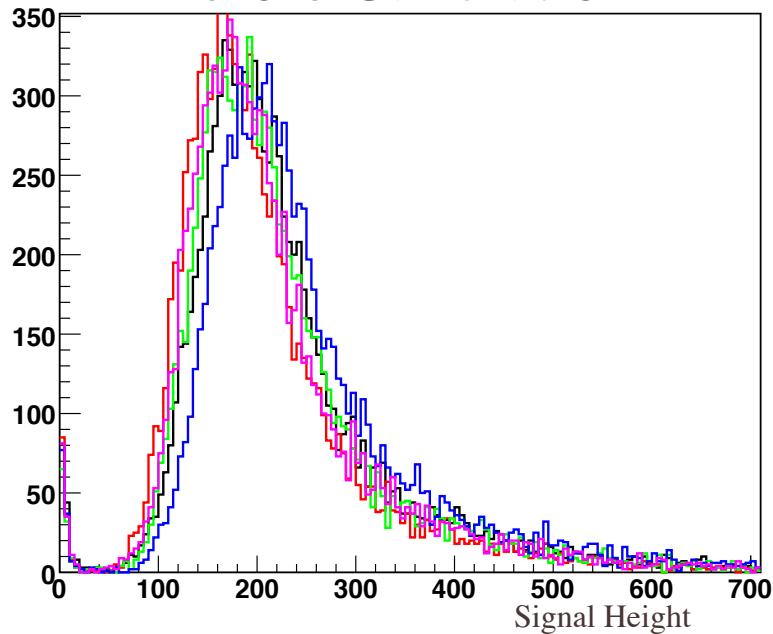


- Mike Lenz put some wrap, so LEDs does not come out of the holes.
- It adds more to the light output variation.
- Cant do that.

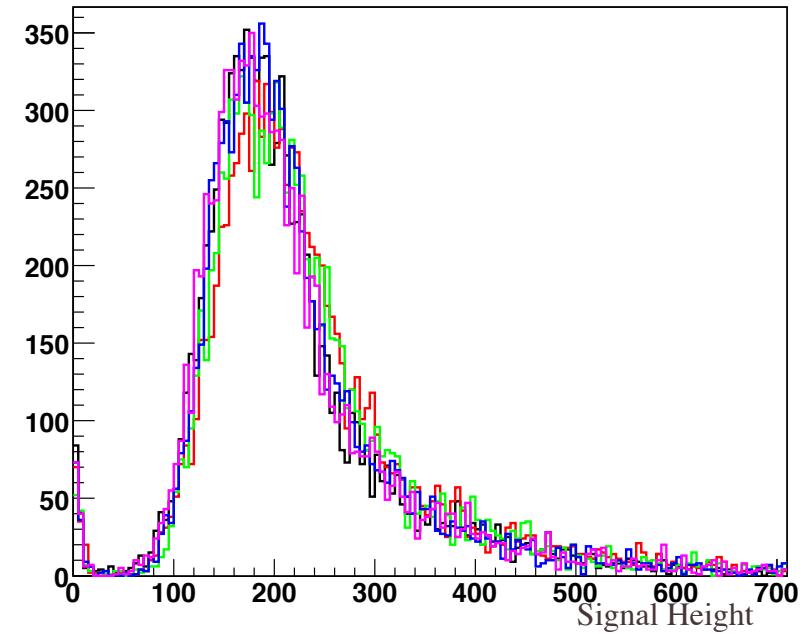
One LED Calibration

Successful calibration with only one LED on the opposite end of the SiPM.

Before Calibration



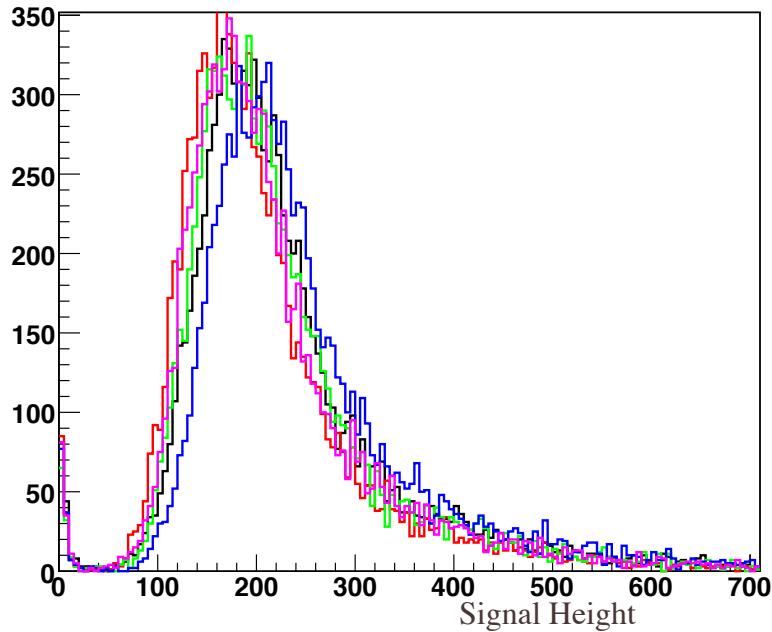
After Calibration



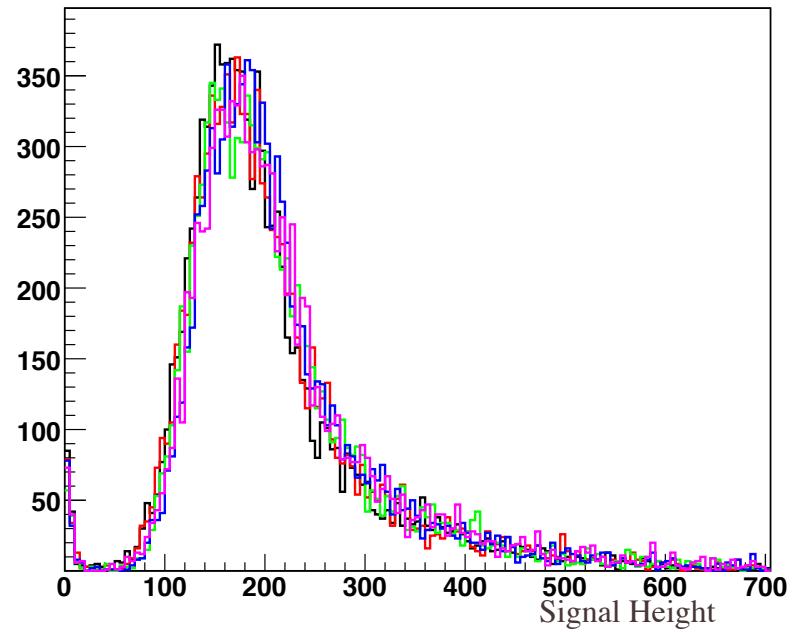
Shown in HCAL fest, tested again with different setup.

Multi LED calibration

Before Calibration



After Calibration



Two step process:

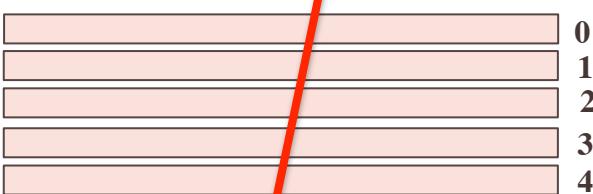
1. Calibrate LED among themselves.
2. Use those calibrated LEDs to calibrate the tiles.

In both cases, we need the hole opened on the other side of SIPM.

Self Trigger

Self trigger in a tower

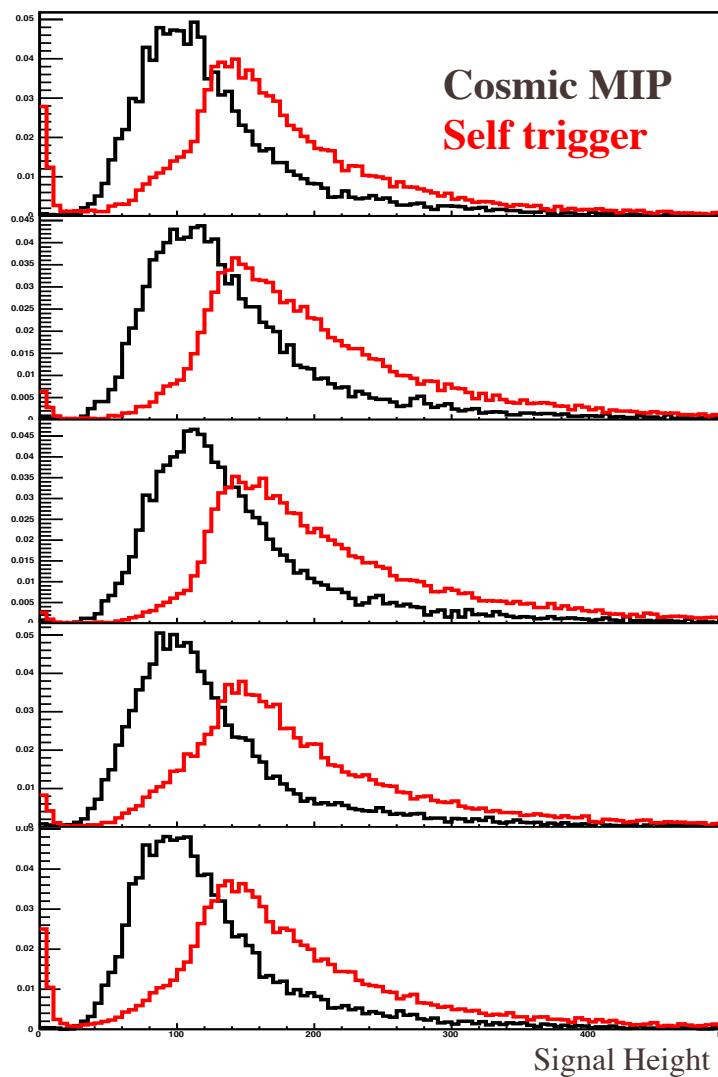
Setup:



4 hit out of 5.

Useful to find out efficiency of the tiles.

Trigger rate was 10x than cosmic rate.



Threshold too high?

Try some more later.

Summary and to-do

- ❖ We were measuring more big tiles because plan was to build the outer hcal first.
 - John H suggested to build the small one first!
 - Most of the small ones does not have holders.
- ❖ More test needed for LED calibration.
- ❖ Plan:
 - Cosmic test small tiles and start assembly.
 - Finish both assembly by end of January.
 - Abhisek will be away next two weeks. Megan will take care.